$$[U_A]_{nm} = \frac{1}{N}\sum_{k=0}^{N-1} \mathrm{e}^{\frac{2\pi ik(n-Am)}{N}} \equiv [F_N^{-1}G_N]_{nm}$$

$$[F_N]_{nm} = \frac{1}{\sqrt{N}}\mathrm{e}^{-\frac{2\pi inm}{N}}$$

$$[G_N]_{nm} = \frac{1}{\sqrt{N}}\mathrm{e}^{-\frac{2\pi iAnm}{N}}$$